

Zonitoides arboreus (Say). Between Kingsmere and Waskesiu lakes. Typical.

Discus cronkhitei (Newcomb). Crean Lake. Typical.

Discus cronkhitei anthonyi (Pilsbry). Ajawaan Lake. The periphery is bluntly angular but it is apparently not the race *catskillensis*.

Cochlicopa lubrica (Müller). Between Kingsmere and Waskesiu lakes. Typical.

Succinea retusa Lea. Ajawaan Lake. One specimen, typical.

Deroceras campestre (Say). Ajawaan Lake. One specimen, rather small but a form of this species.

CIVILIZATION AND LAND MOLLUSKS IN OHIO

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In 1911 Victor Sterki published in the NAUTILUS, Volume 23, pp. 98-101, a paper entitled "Civilization and Snails." In this paper he compared the present condition and abundance of land and fresh-water mollusks with the conditions which obtained fifty or seventy years previously. He referred to the changes produced by deforestation and cultivation, stating that at the time of writing there was in Ohio only about ten or twenty per cent of the number of mollusks that had formerly inhabited the area a half century before. Furthermore, he stated that there were exceptions in the case of some nine species that had actually been benefited by the changes wrought by the white man.

In the light of present-day conditions, Sterki's presentation of the case seems to suffer definitely from under-statement. This is rather surprising from two points of view. First of all, Sterki was a very careful observer, and secondly, it does not seem possible that there have been any great changes within the last twenty-five years. At any rate I have found a rather different situation within the last few years. With this very problem in mind I have made observations on the Ohio land mollusks during four collecting trips undertaken since 1932, and these observations have been further corroborated by work done in the neighboring portions of Michigan.



Taking up first the condition of the vegetation, we find a set-up which is exactly what Sterki hinted at, and that is that deforestation and cultivation have been very extensive in Ohio. Throughout western Ohio agriculture has served to bring about the elimination of most of the forest cover, except in the ravines and on the slopes of low hills. Otherwise arboreal cover exists chiefly as woodlots. Practically the same statement applies to the level region bordering Lake Erie, for here, too, all the cultivable land has been put to the plow or planted in orchards. In the remaining and more rugged parts of the state the woodland cover is a little more extensive, excepting the eastern portion where coal mines and steel mills have exacted their toll of the forests. In the latter area the forests were almost completely removed in order that the timber might be used as mine props or during one period for charcoal in iron reduction. Coupled with this the farmer required considerable area for agriculture. However, the rather poor soil petered out, and worn-out land was then converted into pasture for live stock. All this leaves only the rugged central and south-central parts with any appreciable woodland, but here again pastures have increased in acreage at the expense of the forest, and finally fires have added to the destruction.

While the picture of the present-day molluscan assemblages is by no means complete, enough has been observed to indicate that the land mollusks have by no means been reduced to the extent that Sterki indicated. Indeed except for two potent but rather transitory factors there appears to be no real reduction in numbers of individuals and only a partial reduction in species. The most depressing factors are heavy grazing and plowing. Moderate grazing does only a small amount of harm to the fauna. Even heavy grazing does not limit the snails, providing there is some protection afforded by rocks, boards and fences. An area from which the grazing factor has been removed is soon extensively re-invaded through the lateral migration of the snails. The same is true in the case of fallow fields. Roadsides, orchards, slopes too steep to be effectively grazed, rural dumps, vacant lots and to some extent lawns in urban centers—these all are favorable for quite a variety of mollusks. The species frequenting open

country are adaptive species. Some of the species occurring in such habitats are apparently too specialized to be abundant under forest conditions, but find ideal conditions where man has altered the vegetation cover. We find various grades of "adaptives," some abundant, some only moderately common, and a few rare, though present. Certain species are so closely tied up with forest cover that they are entirely absent in open country, and are thus automatically eliminated where deforestation has been thorough. A case in point is *Polygyra palliata* (Say).

What Sterki says in regard to various members of the genera, *Zonitoides*, *Gastrocopta*, *Vallonia*, *Gonyodiscus*, *Hawaiiia*, *Pupoides*, *Vertigo*, and the slugs is quite in accord with later experience. However, at least species of *Polygyra* live in the open, six of them commonly so. These snails are apt to be overlooked by the casual observer and also by the malacologist, because they live quite out of sight, in grass, herbaceous weeds, and shrubs. Roadside shrubs in Ohio correspond pretty closely with the hedges, a paradise for malacologists in Europe. In short many *Polygyras* are quite as much at home in the open as the European *Helices*, but live too inconspicuously except in wet weather. The following species of *Polygyra* are known to live in open country in Ohio:

Polygyra albolabris (Say). This species lives in open fields, in grass, under boards; in roadside thickets, hiding in plant trash; in wild-grape thickets; among rocks in waste-places. This species is less common in the open than in the mature forests.

Polygyra clausa (Say). Very abundant in roadside weeds and on railroad embankments. It is rare in forests.

Polygyra profunda (Say). Present only where the ground is fairly damp and rocky, with a dense, weedy cover. It lives among rocks, in hawthorn thickets, and is most abundant on the rocky deforested bluffs above the Ohio River.

Polygyra thyroidus (Say). In weedy, grassy fields, often under boards; sometimes abundant.

Polygyra pennsylvanica (Green). This species has been observed to live among rocks in a wet pasture in Adams County.

Polygyra fraudulenta Pilsbry. Often abundant in roadside thickets in eastern Ohio.

Polygyra tridentata (Say). This species is very abundant in open country. It lives under rocks, stones, and boards in fields and along roads. It is quite partial to shrubby thickets. It is also common in grass and herbaceous weeds in fields, and lives in urban vicinities among rocks, stones, boards, and rubbish.

Polygyra inflecta (Say). Abundant in orchards and fields under boards and rocks; common in roadside thickets.

Polygyra hirsuta (Say). This species is most common either on the edges of thin, open woods or in open country, but less common in deep woods (except where recent fires have occurred). It is very abundant in fields and pastures in grass and weeds or hiding under logs, boards, and stones. It is apt to be overlooked by the collector who fails to search deep down in the grass. It also favors wild-grape thickets and roadside shrubs, among dead leaves and the fallen stems of certain weeds.

Polygyra fraterna (Say). Like *P. clausa* this snail is notably rare in woods (except where fires have swept through). It is common in grass along roads and in fields, and to some extent stones and boards. The adults tend to shun the deeper shade of shrubs (except during hibernation).

Polygyra monodon (Rackett). Common in meadows, orchards and on railroad embankments, in grass, weeds, and under boards.

Anguispira alternata is a very abundant culture snail in western and northern Ohio, and inhabits walls, roadsides, railroad embankments, etc. It is not very common in grass, and seems to require the adequate shelter of burdocks and other tall weeds, as well as boards, rocks, and shrubs. *Helicodiscus parallelus* is abundant in very rocky places in fields and in walls. *Gonyodiscus cronkhitei anthonyi* is abundant under stones and in weeds along roads, under stones, boards, and rubbish in fields and vacant lots. *Gonyodiscus perspectivus*, although rare in open country, occasionally lives under logs or in grass in fields. *Zonitoides ligerus* lives in grass in fields in large numbers, as well as in weeds, such as soapweed, on railroad embankments; *Z. demissus* is common in grass in fields; *Z. intertextus* lives in grass and weeds (especially on stony ground) in fields, and on rocky river river bluffs in eastern Ohio, but is never common. *Z. arboreus* is fairly frequent in all types of culture zones, rural

and urban. *Gastrocopta armifera* and *Pupoides marginatus* are rare or absent in woods, but abundant in fields, on railroad embankments, and also in rocky, open country. The other *Gastrocoptas* (*pentodon* and *contracta*) are rare in open country, except on stony or rocky ground. *Vertigo tridentata* and *V. ventricosa* have similar preferences, while *V. pygmaea* is less exacting, for it lives in the same habitats as *Vallonia pulchella* and *V. costata*. Both of the Vallonias are common in open country, at least on less acid soils. *Hawaiiia minuscula* is indifferent as far as the presence or absence of lime is concerned. It is partial to open grassy and stony country. *Cochlicopa lubrica* is certainly more common in open country than in woodland cover. *Retinella indentata* lives in grass and under stones in fields and other types of open country, and is quite often found buried in plant trash in shrubby thickets; *R. wheatleyi* has almost identical habits, while *R. electrina* is more partial to grass and weeds than to stony cover. Of the genus *Mesomphix* we find *inornatus* and *perlaevis* living under stones on bare river bluffs and in vacant lots, all in eastern Ohio. Neither of the species are at all common in open country. *Agriolimax (Deroceras) laevis campestris* and *A. agrestis* live in open fields, in grass or under rocks and boards, and also occur in urban surroundings. *Haplotrema concavum* occurs sporadically in grass and weeds in company with its molluscan prey.

From all the evidence gathered so far, it seems clear that a very considerable and adaptive fauna is in the process of taking over the open country created by agriculture, industry, and human occupation in eastern Ohio. In many instances many species are now more abundant per square acre than they were under the old forest conditions. Other species are greatly limited by culture conditions, even though they do affect open country, while some are actually eliminated or locally extirpated. It is significant that the major part of this assemblage of culture species is of American and not of European origin, contrary to the predictions of some naturalists a few years ago.